**JOHNSON COUNTY RADIO AMATEURS CLUB, INC.**
P.O. Box 93
Shawnee Mission, KS 66201

# FEEDBACK

**FEBRUARY 2016**

## *JCRAC Explores the Capabilities of a WIRES Repeater*

**Jay Burgherr, NØFB**, introduced the membership to his digital WIRES-X node--Kansas City's first--on the JCRAC's 442.600 repeater at 65th and Quivira.

WIRES is Yaesu's "wide-coverage Internet repeater enhancement system" with which Yaesu uses the Internet to connect to other WIRES-enabled machines around the world.

The owner of a WIRES machine (a node) may create a virtual "room" to which other nodes--hundreds at a time--may connect. Although it takes a WIRES-enabled rig to connect and disconnect a node to different rooms, when the node is connected to a repeater, anyone who can connect to the repeater effectively enters the "room" and may participate in international conversations.

Jay configured a public "Kansas City" room to be a place where people--in or out of town--could talk to Kansas Citians. He showed the club various rooms and conducted a QSO from the club meeting room, through the 442.60 repeater via WIRES to a ham in Pennsylvania.

Although he has not preserved the system logs--the system periodically overwrites them--Jay asserted that thought it safe to claim that hundreds of DX stations had connected to Kansas City through this node.

At present the WIRES node at the 442.60 repeater connects by way of an RF link to an Internet connection at Jay's home. Jay's hope is that the club will install an Internet connection at the repeater site and that he can transfer the equipment and node to the club.

The JCRAC repeater is configured as a digital-only unit, which limits local participation to people who have 70cm radios with the Yaesu "Fusion" technology.

*NØFB connects to the WIRES world with his Yaesu FT 400 DR*

### *FEBRUARY MEETINGS*

***February 12** – Gonset Gear - Dennis Baker, KEØQM*

***February 26** – SWR and Other Mysteries - Bill Brinker, WAØCBW*

The Johnson County Radio Amateurs Club normally meets on the 2nd and 4th Fridays of each month at 7:30 PM at the Overland Park Christian Church (north entrance), 7600 West 75th Street (75th and Conser), west of the Fire Station.

Much of the membership travels to the Pizza Shoppe at 8915 Santa Fe Drive for pizza buffet and an informal continuation/criticism/clarification of the topics raised at the meeting ... or anything else.

*Mike Laney, KEØGHU*

*Richard Bowden,* KEØFWR

*Greg Wolfe, KIØKK*

*John Johnston, WBØMPB*

*Be sure to introduce yourself to these new members and visitors who first attended a JCRAC meeting in January.*

*Cary Bownds*

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*A publication of the*
*Johnson County Radio Amateur Club, Inc.*

**Bill Gery, KA2FNK, President**

**Aaron Boots, AAØRN, Vice President**

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**----------**

### *Have you heard the one about ...*

An engineer, a lawyer, and a surgeon walked into a Pizza Shoppe and sat down at a table with your Editor after a JCRAC meeting. Your Editor, who was learning CW, asked the doctor which hand CW operators typically used to operate their equipment. Your Editor speculated that perhaps he should learn to key with his non-dominant hand so that his dominant hand would be free for writing. The engineer interrupted to say that he used his dominant hand. The doctor said that in his experience CW keyers preferred to use their dominant hands, although he used his non-dominant hand for precisely the reason your Editor suggested. Your Editor observed that if most CW people, being right-handed, used their right hands to key, he--being left-handed--should probably learn to key right-handed so that he could slide into a CW station at Field Day without having to reorganize the station.

The doctor revealed that he, too, was left-handed and the table-mates took off into an exploration of knot-tying, why surgical residencies used to exclude left-handed people, why guitars are strung the way they are, the ratio of right- to left-handed people in PhD programs, corporate management and homeless shelters. (It turns out that lefties are statistically--well, maybe just anecdotally--over-represented in all three groups.)

Radio brought the group together and touched off a discussion that shot-off in delightfully unpredictable directions. If you don't attend the JCRAC after-meeting, you're missing out on part of the fun our hobby offers.

See you there next time.

## *PRESIDENT'S CORNER*

Here it is February and believe it or not **Don Warkentien, WØDEW**, has already coordinated the first campfire cookout of the year a campfire at the Ensor Farm.

The second monthly meeting which is on February 26 will be in the fireside room at the church. For this meeting please enter on the east side of the church as there will an ongoing activity which will be needing the normal north entrance.

There will be a Technician licensing class February 20 and 27 at the National Weather Service Training Center near Airport. If you know of anyone who has an interest in amateur radio, please point them to the web site "hamclass.org" for information about the class and how to sign up.

The public service event section of Larry's List is beginning to fill. Community service, is of course, a fine thing in and of itself, but the benefits flow both ways. Volunteering to help at these events is a proven way to increase your skill as an Amateur radio operator. Knowing how to operate your equipment and collecting experience with tactical network operation is the way to make yourself into an important player during an emergency.

***– Bill Gery – WA2FNK***

## *Johnson County Radio Amateurs Club - January 8, 2016*

Meeting Date: Friday January 8, 2016. The meeting Started at 7:30PM.

Attendance: Self introduction with name and call sign. 40 signed the check in sheet. This was followed by the Pledge of Allegiance.

No Minutes were read.

The Treasurer's report, as follows, was read and accepted unanimously.

| | |
|---|---|
| Cash on Hand | $ 101.35 |
| Checking Account | $ 236.10 |
| Savings Account | $ 9,973.26 |
| Total | $ 10,310.71 |
| Repeater Operating Reserve | $ 674.44 |
| Memorial Fund | $ 310.00 |
| Active Members | 135 |

Old Business:

- Repeater Update – All Repeaters are working well. Jay Burgherr, N0FB is currently working on implementing Wires-X on the 442.600 Yaesu DR-1X repeater. More details to follow.
- Official Club Name Badges – Orders will be placed through Cal, KC0CL. Cost is $9 each.
- WW1USA – Upcoming Event which will be February 13-14. And as a reminder our Club is organizing the May 8-9 Event (which will be outside).
- Field Day 2016 – June 25-26 at the Observation Tower in Shawnee Mission Park (double checking to make sure we have it).

New Business:

- None.

Reports:

- 6 m – Currently the band is Open.
- 10 m SSB Roundtable – 2 participated on January 7 and 8 participated on December 31.
- 440 Wheat Shocker net – NR participated on January 6 and NR participated on December 30.
- 2m Wheat Shocker net – 21 participated on January 7 and 21 participated on December 31.
- HF Activity – South Africa on 40m, South America and France on 10m, Pluto Special Event Station with Doug, N3PDT, Contact with AD4NT in S. Carolina who is a 90 year olds and learned Ham Radio from Marshal Ensor over the air in 1939!

Announcements:

- Welcome to all the 1st time visitors.
- TWIT TV's Ham Nation recently showed a video on the Marshall Ensor Story. That video can be seen at Ensor Park and Museum website.
- Storm Spotter Training in late January. Go to K0ECS.org for details.
- Watch Larry's List for upcoming events.

Business meeting adjourned at 7:54 PM

Program:

Planning session for 2016 Programs.

## *Johnson County Radio Amateurs Club - January XX, 2016*

Attendance: Self introduction with name and call sign. 56 signed the check in sheet. This was followed by the Pledge of Allegiance.

The Minutes from the January 8, 2016 were accepted with 1 opposed vote.

The Treasurer's report, as follows, was read and accepted unanimously.

| | | | |
|---|---|---|---|
| Cash on Hand | $ 98.35 | Repeater Operating Reserve | $ 682.44 |
| Checking Account | $ 274.02 | Memorial Fund | $ 310.00 |
| Savings Account | $ 9,973.26 | | |
| Total | $ 10,345.63 | Active Members | 144 |

Old Business:

- Repeater Update – All Repeaters are working well. Recently a visual inspection of the Antenna on top of the Black and Veatch was done. Bill Brinker, WA0CBW is working with Black and Veatch to get on top of the roof so necessary work can be completed on that antenna.
- Official Club Name Badges – Orders will be placed through Cal, KC0CL. Cost is $9 each.
- WW1USA – Upcoming Event which will be February 13-14. And as a reminder our Club is organizing the May 8-9 Event (which will be outside).
- Field Day 2016 – June 25-26 at the Observation Tower in Shawnee Mission Park.

New Business:

- Bill Gery, KA2FNK made the suggestion that we do away with reading of the Minutes from the previous meeting. Instead, the minutes would be posted on the Website for club member to read prior to the meeting then during the meeting we would vote on approval of those minutes. Due to lack of support this idea was tabled.
- The Club recently implemented Wires-X on the 442.600 Yaesu DR-1X repeater. Currently the node and connection to the internet is at the home of Jay Burgherr, N0FB. The permeant solution is to have the node located at the Repeater site in Shawnee. In order to make this happen the Club will need to purchase some node equipment. More details to follow on this.
- Harry Wilson, KA0JLN has asked for the Club's help in selling some of his Ham Radio equipment. He is moving and needs this to happen soon. Cal Lewandowski, KC0CL made the suggestion that the Club purchase Harry's equipment for a reasonable price and then put these items in the Club's Auction in October. A suggestion was also made to possibly let the membership purchase these items prior to being placed in the Auction. More information will be made available once a total reasonable price has been determined. Also an offer was made to help Harry set up a station at his new location if he is interested.
- Dan Carr, owner of Electronic Technologies Inc., has donated to the Club about 300+ feet of 1.25 inch hardline. This extremely large and heavy Spool is in Bill Gery's, KA2FNK garage.
- Don Reed, K0IFO reported that the city of Independence recently installed LED Street Lights. These LED light are creating a lot of RF Noise. If you are affected by this feel free to file a complaint with the FCC.

Reports:

- 6 m – NR.
- 10 m SSB Roundtable – 2 participated on January 21.
- 440 Wheat Shocker net – 19 participated on January 20 and 17 participated on January 13.
- 2m Wheat Shocker net – 23 participated on January 21 and 19 participated on January 14.
- HF Activity – Bonaire and the Canary Islands, Hawaii, South Sandwich Islands on 20m.

Announcements:

- Welcome to all the 1st time visitors.
- Special welcome to Dan Harlow, KF0RS from Associated Radio.
- LaCygne Hamfest – Feb. 6.
- Storm Spotter Training in late January. Go to K0ECS.org for details.
- Hamclass.org will hold a Technician Class on Feb. 20 and 27. See Hamclass.org for details.
- Winter Field Day sponsored by the Winter Field Day Association (WFDA) is January 30-31. Rules can be found at winterfieldday.com
- Watch Larry's List for upcoming events.

Business meeting adjourned at 8:01 PM

Program: The Program for this meeting was presentation on Yaesu's Wires-X by Jay Burgherr, N0FB.

## Hambone and the Mysterious Black Box -- *Jaimie Charlton, AD0AB*

"Hi Hambone, whatcha got there?" asked his Uncle Elmer when he saw his nephew puzzling over a small tan box with four terminals on it. Hambone, home on break from college, had been unusually quiet for the last few days.

"Oh, hi, Unck. I'm just trying to figure out what's in this box. It's the midterm exam in my Circuit Analysis class. The instructor, your old friend, Professor Bunzen J. Berner, gave each of us a different box and said our test is to figure out what's in it by making measurements on its terminals. We can use any electronic instruments we can find and can apply voltages up to 10 volts to the terminals, but we can't open the box, X-ray it or use any other, non-electronic means to determine its contents. Oh, and if we damage the box or its contents, we get an 'F'."

I'm stumped. The only markings it has are my name and the terminals labeled A, B, C and D. And it's tan even though the old prof calls it his 'black box quiz'."

"Did Professor Berner give you any sort of additional information or did he say anything at all about the boxes?" asked Elmer.

"He did say to use all the information we have, but remember the KISS principle and don't over analyze it. And then he added something strange. He said, 'Don't *assume* anything, it can make an *ass* out of *u* and *me*.' What do you suppose that means?"

"I don't know, but it definitely means something. Berner is very tricky that way. It's your problem to solve, but maybe I can guide you a little. Start out by listing what you know," continued Elmer.

"I just told you everything, the box has four terminals labeled A, B, C and D, it has my name on it and it's tan, that's it!" Said Hambone, his voice starting to show signs of frustration with the seemingly unsolvable problem.

"Oh, so not so, my boy," soothed Elmer. "What have you been studying lately in this class?"

"Well, we started with simple diode circuits, then we moved on to junction transistors, both PNP and NPN. We start with FETs next week. Of course, we also used resistors capacitors and transformers and Ohm's Law and stuff like that. But mostly we studied semiconductors."

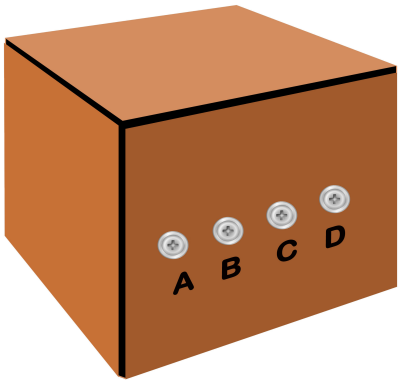
"Then you know quite a bit more. It is likely your box contains something related to diodes or transistors. After all, the teacher wouldn't give you a midterm on something you haven't covered in class. Is the box very heavy?" asked Elmer.

"No, it's so light that it feels empty."

"That tells us it does not contain an iron core transformer or some heavy component like a big power resistor. So we, er, you, can eliminate those components from consideration. Is the box truly opaque, or can you see through it if you hold it up to the sunlight?"

Holding the box up to the sunlight streaming through the window, Hambone confirmed that the box was opaque and he could not see anything inside.

"Now, let's summarize what you know, again. The box is a tan cube, about three inches on a side, it's light weight and has four terminals. Since you are studying semiconductors, it probably has something to do with them. His warning of not exceeding 10 volts also supports that the box may contain small semiconductors. Finally, you know that Professor Berner's hint is probably a good one. Let's start with some resistance measurements."




Feeling a bit more confident, Hambone grabbed a digital multimeter and selected the 'ohms' scale. "Unck, we could start by making a chart of resistances between the terminals. We did that a while back in class when we were graphing the characteristics of a light bulb. Berner likes charts."

"Okay," said Elmer with his yellow pad at the ready.

"Unck, we'd better measure the resistance in both directions just in case there are diodes or something in there. I'll make the chart so that the positive meter test lead goes on the first letter and the negative test lead goes on the second one in the list," said Hambone as he quickly made measurements and Elmer wrote done the following list of values.

***see HAMBONE on page 6***

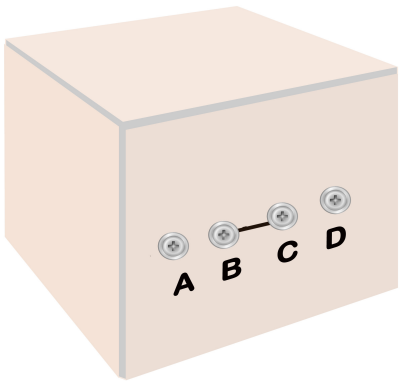
***from HAMBONE on page 5***

Resistances in Ohms

| . | A | B | C | D |
|---|---|---|---|---|
| A -> | – | ∞ | ∞ | ∞ |
| B -> | ∞ | – | 0 | ∞ |
| C -> | ∞ | 0 | – | ∞ |
| D -> | ∞ | ∞ | ∞ | – |

"Wow Unck, that was easy!" Shouted Hambone. "Old man Berner just put a short circuit between terminals B and C and didn't connect anything to the others. I can't wait to write this up and collect my 'A' for the midterm. That was easy and fast."

Hambone took his tan box with his name and four terminals labeled a, B, C and D and drew in a short between terminals B and C.




"Hang on, Hambone, before you get too jolly, think about your results and Professor Berner. You might be exactly right and the box only contains a short between terminals b and c. But, he's a tricky guy and it *is* a midterm exam. Maybe you should investigate a little further."

"Like what, Unck?"

"Like, I can't do your exam for you, that would be cheating. But if I were you, I might switch the multimeter to its diode testing function and repeat the measurements. That's only a suggestion, mind you. But, let's not forget who's making it." Said Elmer with a sly smile on his face.

Grudgingly, Hambone followed his uncle's suggestion and got a rude surprise.

"Unck, there is something strange going on in that box. I hooked the meter up as you said and it read 0.68 volts A to B and 0.68 volts A to D. But, it only read 'OF' or Over Flow when I reversed the test leads. Do you suppose that there is some sort of tricky circuit with a battery inside the box?"

"Slow down there, cowboy. I don't know what's in the box, but think about what the diode test function on the meter actually does."

"Doesn't it just measure resistance?" asked Hambone.

"No, the scale says 'volts' and that's what it measures. The meter actually runs a small current through the device under test and measures the voltage drop across the device that the current causes. In this case, you measured 0.68 volts and, basically, an open circuit when you reversed the test leads."

"I've got it! That's the normal forward voltage drop of a silicon diode!" shouted Hambone. "The meter shows 'OF' when reversed because the diode is an open circuit when it is reverse biased."

"By Jove, you have got it!" laughed Elmer as he cheered on his young nephew.

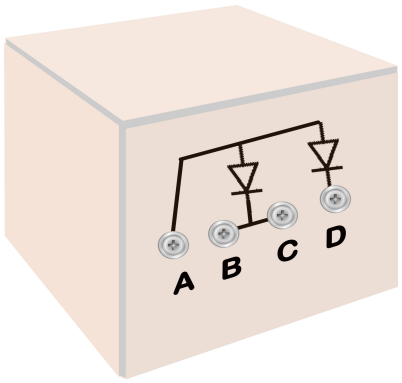
"But Unck, if it is a diode inside there, why did the ohmmeter show open circuit in both directions? Shouldn't it show at least some resistance in the forward direction?"

"Good question, Hambone. The ohmmeter shows an open circuit in the forward direction because it only applies about 150 millivolts when measuring resistance. That is way below the approximate 0.7 volt forward threshold voltage of a silicon diode. The diode won't pass any current unless you apply a forward voltage greater than the threshold voltage. If no current flows, the meter "thinks" it's connected to an open circuit – which it sort of is."

"If the meter only applies 0.15 volts, why does the diode checker function work?"

"When the meter is set for diode testing, it applies about 2.25 volts. That's enough to cause forward current to flow in most common diodes. It limits the current to less than one milliamp and displays the voltage drop that current causes. That's why it showed 0.68 volts."

Satisfied with his uncle's explanation, Hambone grabbed the box and quickly sketched two diodes on the surface showing, schematically, what he believed to be inside.




"Now we are finally done. All the terminals are accounted for and I have a good chart of resistances and voltages. Berner likes that sort of documentation.

***see HAMBONE on page 7***

***from HAMBONE on page 6***

"You may be right but remember the advice Professor Berner gave you about not assuming anything. Have you made any assumptions in reaching your solution?" asked Elmer.

"I don't think so. All my conclusions are based on measurements."

"You might ask yourself what else, besides two diodes, could give those same measurements? Maybe something you've been studying lately."

"Well," mused Hambone. "Some sort of circuit with a battery and a switch could simulate a couple of diodes, I suppose. Or, a transistor could look like two diodes back to back. I guess an NPN silicon transistor with its base connected to A, its emitter connected to B and C and its collector connected to D would give more or less the same readings.

The KISS principle – Keep It Simple Stupid, would rule out a complicated switching circuit. So, I am left with deciding between two diodes or a transistor," said Hambone fishing for more of Elmer's help.

"You could flip a coin," said Elmer, "But I bet you can think of a better way."

"I've got it, again, " said Hambone. "In a transistor, a current flowing between the base and the emitter can cause a current to flow between the collector and emitter. This is called amplification. A transistor can amplify, but two diodes can't. I'll just see if this box can amplify."

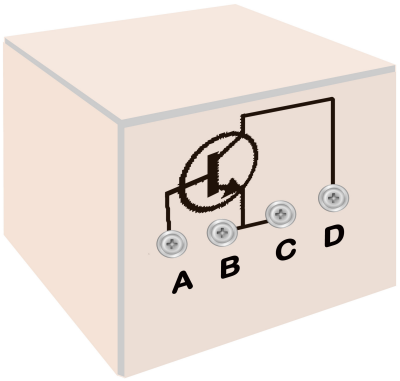
"How are you going to do that?" asked Elmer.

"Simple, I'll just connect an ohmmeter, positive lead to terminal D and the negative lead to B or C. If it is an NPN transistor, terminal D will be the collector and B will be the emitter. The meter will read a very high resistance, like it did when we made that resistance table.

I will then use the diode tester to put a small positive current through terminal A – which would be the base – to the emitter. If this is a transistor, the ohmmeter will show a big drop in collector to emitter resistance because the base current is causing a current to flow from the collector to the emitter. That's the basic transistor operation – a small base current controls a larger collector current.

If there are just two diodes in the box, the resistance between terminals C and D won't change even if we run current through terminals A and C. That's because the diode connected to terminal D is still blocking any current flow," stated Hambone in a very professorial manner.

"Well, look at that, said Hambone as he applied the diode tester to terminals A and B. "The ohmmeter shows only about 200 ohms between terminals D and C, way down from infinity. That means the box contains a transistor and that's my final answer."




***Epilogue***

Hambone was right, the box did contain a transistor and he received an 'A' on the exam. Elmer received nothing as his name was strangely absent from the final write-up. Nevertheless, Professor Bunzen J. Berner asked Hambone to give his regards to his uncle.

## *JCRAC at AmazonSmile*

JCRAC has set up an affinity program with smile.amazon.com.

Amazon will donate 0.5% of the price of eligible Amazon purchases to the JCRAC whenever members (or anyone else who has signed up) shops on Amazon through its AmazonSmile portal.

To sign-up, visit "smile.amazon.com/ch/48-1071476". Thereafter, if members start their Amazon shopping at "smile.amazon.com", Amazon will make a donation to the club.

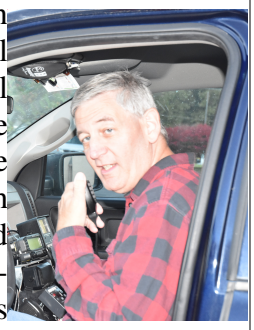
## *CQ Magazines to a Good Home*

**John Raydo, KØIZ** has a boxed collection of "great reading, educational" CQ magazines (1980 - 2013) that he will bring to a club meeting to give to an interested ham. Contact him at 816-914-2367 or kcflyers@yahoo.com.

# A Twin-Tee Code Practice Oscillator - Tom Wheeler, NØGSG

*Introduction*

Last month we introduced a simple code practice oscillator that you can build in an evening--based on the LM555 timer IC--and here we go again with yet another circuit. The LM555-based circuit is great as a first build, but it's a little lacking in the fidelity department; its output is a somewhat harsh square wave with sharp on-off transitions, which adds extra clicks to each transmitted CW element. A code practice oscillator should produce output that's as identical to an on-the-air signal as possible. Real CW signals are nearly pure sine wave tones with smooth on and off behavior. Figure 1 illustrates the difference between the LM555 circuit output (sending three dits) and an ideal CW signal.



In Figure 1 we've connected an oscilloscope to the code key (to show when it's being pressed), the output of a LM555-based circuit, and finally to an "ideal" CW generator. As you can see, the LM555 output abruptly switches on and off for each key press - - that's what makes the clicking sound on each CW element. The square shape of the LM555 output creates a buzzing, blurry sound. This buzzing is due to the presence of extra frequencies called harmonics that are present in the square wave output; a 50/50 duty 1 kHz square wave will have fundamental energy at 1 kHz as well as additional harmonics at 3 kHz, 5 kHz, 7 kHz, and up.

Real CW signals look more like the ideal CW output at the bottom of Figure 1. A good CW signal smoothly grows in strength when the key is pressed, and decays smoothly back to zero when the key is released. Its shape is close to a pure sine wave tone, so that only one audio tone is presented to the listener's ear. Smooth switching behavior and clean sine wave shape make a CW signal much more realistic, and much less fatiguing to listen to.

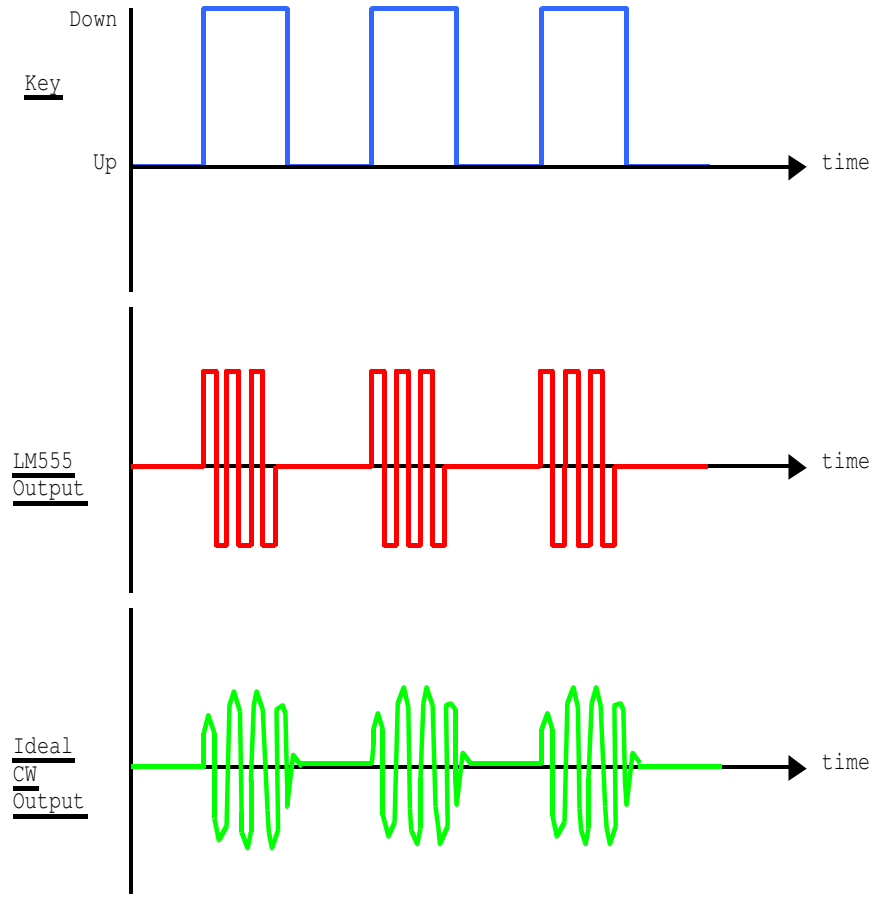



*Figure 1: Output Differences between the LM555 Circuit and an Ideal CW Signal (Not to scale)*

*A Twin-Tee Code Practice Oscillator*

Generating a clean sine wave with a deliberately-shaped keying envelope requires a little more complicated circuit, as shown in Figure 2. The output of this circuit is very much like what you'll hear on-the-air, which is a definite advantage for learning.

In Figure 2, transistor Q2 acts as a sine wave oscillator. The "twin tee" portion of the circuit consists of two "tee" circuits, C4, C5, R7 and R8, and R10, R11, and C11. These components form the feedback network of the oscillator and control its frequency.

Variable resistor R8 allows adjustment of the oscillator frequency or "pitch."

When the circuit is activated, Q2 oscillates continuously, but its

***see TWIN-TEE on page 9***

*from TWIN-TEE on page 8*

output signal is shunted to ground by Q3, the 2SK416 MOSFET, which acts as a closed switch.

When the key is pressed, Q3 begins to turn off (become an open circuit) because C7, the gate capacitor, discharges to ground through R6, the hardness control. Because this change occurs gradually, Q3 gradually turns off, resulting in a smooth off-to-on transition of the CW note. The opposite takes place when the key is released; C7 gradually charges back up through D4 and R5, turning Q3 on gradually, causing the CW note to smoothly fade.

The resulting CW signal is amplified by U1 to a level that can drive the speaker. R12 controls how much signal is applied to U1, thus controlling the volume.

You'll notice that this circuit has no power switch. It doesn't need one, since Q1 acts as an automatic on-off switch. When key is pressed, C3 is charged through D3. This turns on Q1 and applies power to the entire circuit. After around two minutes, C3 discharges through R1, which turns off Q1 and removes power from the circuit automatically.

Diodes D3, D4, and D5 are steering diodes; their purpose is to prevent interference between the different portions of the circuit (signal LED, automatic power switch, and CW shaper) that share the key's signal.

*Construction of the Circuit*

The Twin-Tee circuit can be built on a perforated prototyping board. All grounds should be tied to a common point, and because analog signals are being processed, component leads should be kept short. Use an IC socket for U1.

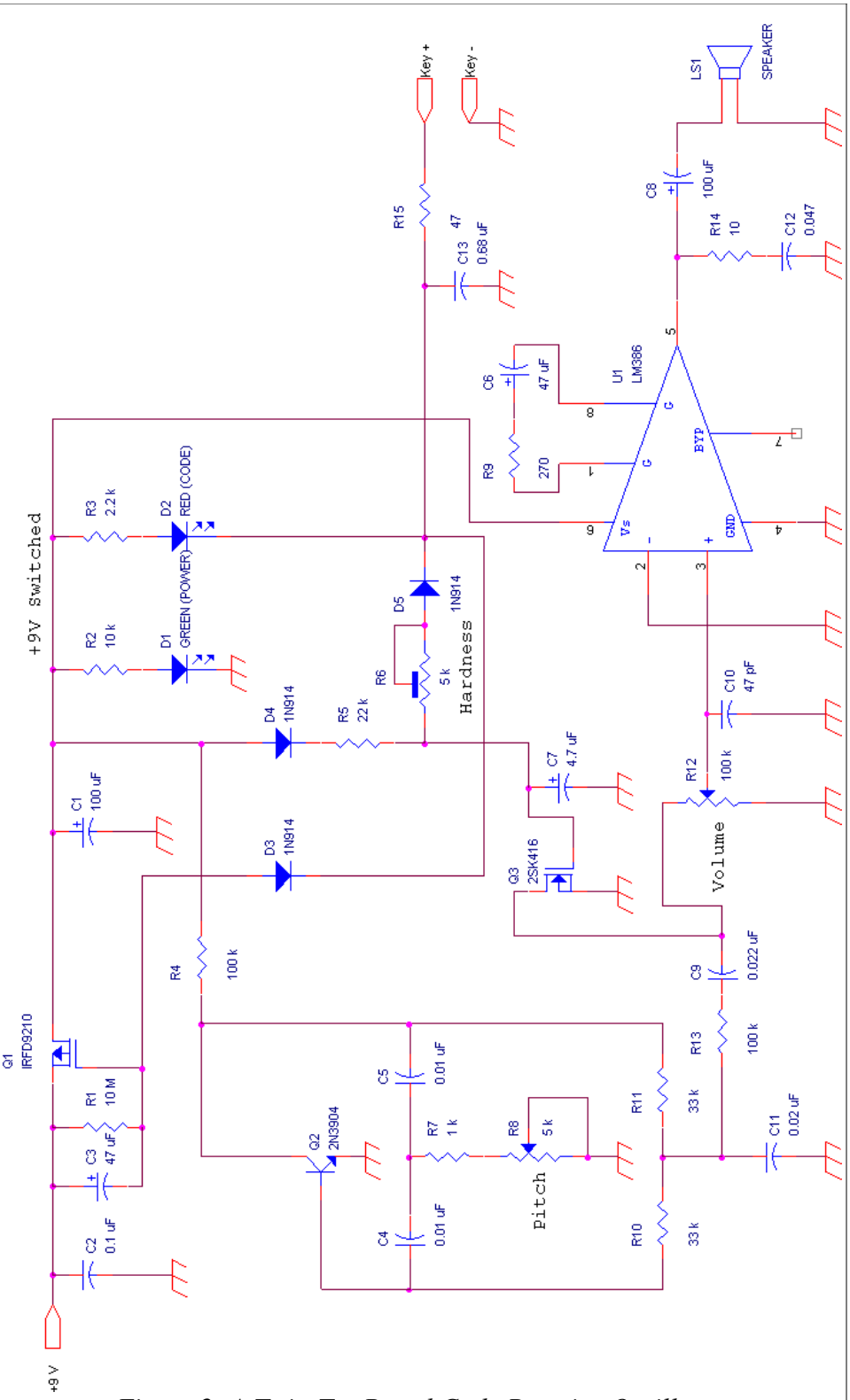



*Figure 2: A Twin-Tee Based Code Practice Oscillator*

Q1 and Q3 are enhancement-mode MOSFET devices and are not critical. Most any N- or P-type devices will work in these two locations. Q2 is also not critical; any general-purpose NPN transistor, such as a 2N2222, 2SC458, and so forth will work fine.

***see TWIN-TEE on page 10***

***from TWIN-TEE on page 9***

Because Q1 and Q3 can be easily damaged by static electricity, make sure to wear an anti-static wrist strap when working with them.

Figure 3 shows a hand-wired version of the circuit, and Figure 4 shows the completed project mounted in an old Realistic code practice oscillator cabinet. *There are quite a few parts in this circuit; building it one stage at a time is recommended*. In stages, construct and test it as follows:

- Automatic Power Switch: Q1, C3, R1, D3, D1, and R2. Check operation by applying +9 V to the circuit, and momentarily ground the cathode of D3. D1 (the green LED) should light and stay on for a couple of minutes, then extinguish.

- Oscillator: Q2, C4, C5, C11, R7, R8, R10, R11, R4, R13, and C9. Check operation by applying 9 V to the circuit, and again ground the cathode of D3. Using an oscilloscope and a 10:1 probe, measure at the right side of C9; you should see a reasonably clean and steady sine wave of at least 100 mV p-p amplitude, and in the frequency range 400 Hz to 1000 Hz (adjustable with R8). As an additional check, the base of Q2 should measure around 0.6 V, the emitter 0 V, and the collector between 3 and 7 V.

- Audio Amplifier: U1, R12, C10, R9, C6, R14, C12, C8, and the speaker. Once you've built the audio amp, applying 9 V and grounding the cathode of D3 should result in a steady, continuous tone from the speaker that stops after automatic power off occurs. Voltmeter checks on U1's pins show read as shown below (+/- 20%):

| U1 Pin | Voltage |
|---|---|
| 2,3,4 | 0 V |
| 6 | 9 V |
| 5 | 4.5 V |

- AF Gate: Q3, C7, D2, D4, D5, R5, R6, R15, C13. Once these components are in place, the unit should operate as advertised - - no tone should be emitted until the key circuit is closed.

*Adjustment and Check Out*

This circuit depends on the characteristics of Q3, the audio switching MOSFET, to develop the correct shape of the CW waveform. Because unit-to-unit variations will occur with Q3, a hardness control has been incorporated to allow final tuning of the CW envelope shape.

Adjustment is simple--simply transmit a series of dits at about 18 to 30 words per minute (WPM) and adjust R6 until the sound is correct. The dits should be distinct, but not harsh.

Otherwise, this is a circuit that should just work. You may want to verify that the unit does properly turn itself off after a couple minutes of inactivity; the green power LED, D1, should extinguish. (You may hear a few assorted pops from the speaker as the unit turns off; this is normal behavior).

You can simplify the circuit by simply deleting the automatic power switch section, comprised of Q1, C3, D3, and R1; if you do this, don't forget to add a power switch!

*Conclusion*

The improved code practice oscillator described in this article will provide very realistic and pleasant-sounding Morse code. If you're looking for an extra challenge, give this circuit a try. If there's sufficient interest, we will generate printed circuit boards for the project, which greatly simplifies assembly.

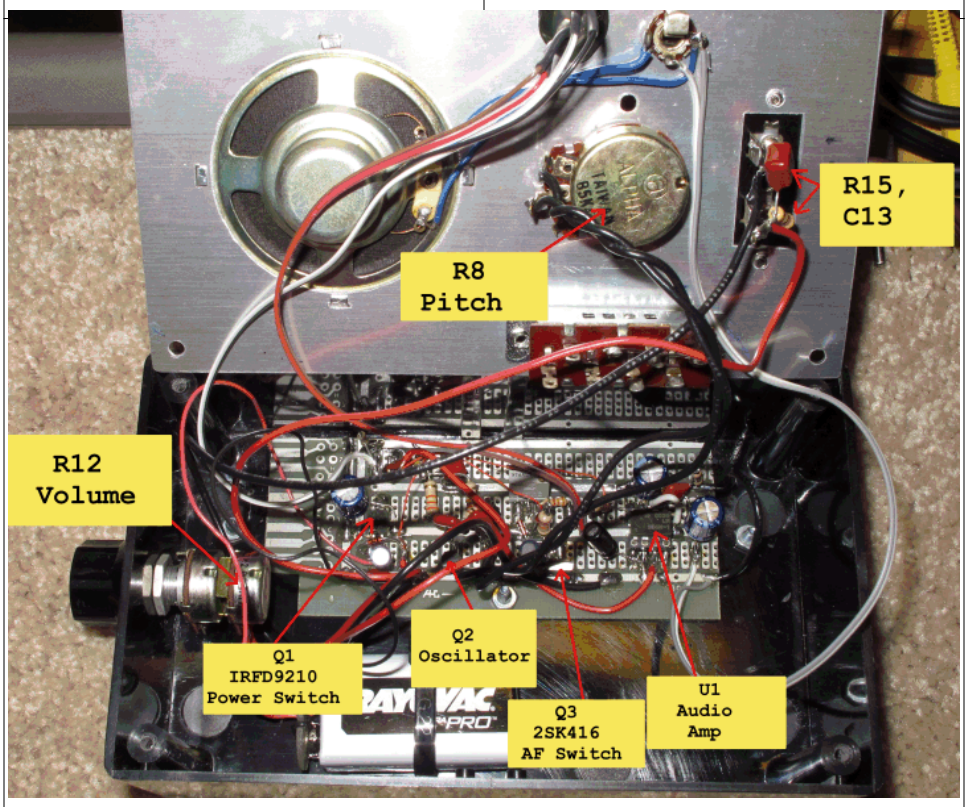
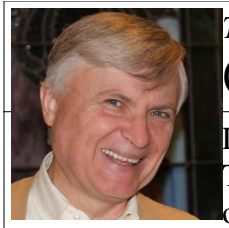



*Figure 3: Components and Wiring*



*The "Amateur" in "Amateur Radio" -- Chip Buckner, ACØYF*

# Continuing the Journey

Last time, we built Tom's code practice oscillator. I confess considerable excitement that I did it, it made a sound and that it did not explode or in some other way hurt anyone.

But that was last month. Now, on to something new. But first, ...

***Let's Not Build Tom's improved Code Practice Oscillator … Yet***

**Tom Wheeler, NØGSG**, **Jaimie Charlton, ADØAB**, and **Don Warkentien, WØDEW**, all tell me that Tom's revised CPO published in this issue of the FEEDBACK is far superior to the one published last month. I've ordered the parts, but the MOSFETs[1] haven't arrived, so a build article is going to have to wait until next month.

Actually, one of the MOSFETs--the IRFD9210 (Q1)--has arrived, but the 2SK416 (Q3) has not. Because Tom said that the values of MOSFETs Q1 and Q3 were not critical, I figured that I could substitute one of my surplus Q1's for a Q3. My problem was that I couldn't tell from Tom's schematic what pin went where. So, armed with the schematic, I went to the club meeting looking for Tom.

Tom--in case you didn't know--is both very patient and very kind. It turns out that the value of Q3 isn't THAT not-critical. So, construction will have to wait until I get the part.

***Speaking of Parts***

Several hours after sending the January FEEDBACK to **Cal Lewandowski, KCØCL**, for distribution to the club, I found myself in Microcenter, hunting for a cable with a 2.5mm plug for what I hope will be an upcoming project. I didn't find the cable, but I did find—in the "Hobbies" section—breadboards, assortments of resistors, capacitors and transistors, and a variety of other parts for electronics projects.

My impression is that the inventory is geared toward Arduino (a microcontroller board) and Raspberry Pi (small computer) builders. Johnson Countians are likely to prefer Microcenter's hours and location to those of Electronics Supply. On the things I checked, Microcenter prices were comparable to or higher than prices at Electronics Supply.

***On the Air***

I like my CPO, but it isn't wireless, which is sort of important when you're dealing with an amateur radio project. Let's send some Morse code over the airwaves.

"Do you", **Don Warkentien WØDEW** asked me at a recent post-club-meeting meeting at Pizza Shoppe, "know how you get a tone when you listen CW on a modern transceiver?" It had never occurred to me to worry about such a thing. Don launched into an explanation that included beat frequency oscillators and heterodynes. I nodded sagely and, when I got home, visited Google. I then closed my browser. If I ever understand this, it is going to happen substantially later in my educational process.

I bet Marconi didn't know what they were, either. And my equipment is way better than what he had. Let's see if we can't send Morse code over the air without using either of those things.

***Attempt #1 -- On/Off with PTT***

The simplest thing to do would be to use the push-to-talk button as your Morse code key.[2]

*Tune two HTs to a simplex frequency.*

*Recruit a volunteer who knows (or who can be made to understand) the Morse code letters R and K.*

*Call your volunteer over the air. Cover the microphone (so that the HT does not pick up extraneous audio noise), then use the PTT button to send either an R or a K. Uncover the microphone. Repeat your call sign, so that your volunteer knows that you're through playing with the PTT button.*

*Your volunteer then does the same thing, using her call sign, of course.*

The HT creates and sends a "carrier" wave at the tuned simplex frequency. Before the signal leaves the HT, however, the HT "modulates" the carrier by mixing in an audio wave—typically your voice. The HT on the receiving end picks up the complex modulated wave and removes the carrier wave. What is left, after removing the carrier, is the audio wave that the transmitter mixed with the carrier.

I think.

If so, that should mean that no audio wave going into the HT

***see THE AMATEUR on page 12***

[1] Wiki reports that a MOSFET—in case you didn't know, either—is a Metal Oxide Semiconductor Field-Effect Transistor used to amplify or switch electronic signals. I have a wonderful image of applying power to a MOSFET and having it generate a field that amplifies, switches and otherwise affects signals in nearby circuits. That can't be right, but it's a really fun image.

[2] Well, the SIMPLEST thing to do would be to hold down the PTT button and say "di-dah-dit", but that's not terribly interesting.

*from THE AMATEUR on page 11*

means no audio wave can be extracted at the receiving HT. So, PTT keying should not be a good way to send Morse code on a pair of HT's.

Except that I forgot that the HT "displays" signal strength—that is, the presence or absence of the carrier wave—on its S-meter. So, although in the normal case it is the modulating audio wave that contains the information in an FM HT transmission, in this case it was the carrier wave that contained the information. Although there was no audio on the HT, the on-off of the carrier wave was plainly visible on the S-meter.

So I inadvertantly disproved my hypothesis that one could not send Morse code with an HT PTT key.

Nonetheless, I think the PTT key is a less-than-useful way to send Morse code.

First, I suspect that the PTT key wasn't designed to be depressed and released as quickly or as often as we would need to press the key to send code.[3]

Second, the recipient operator's ability to comprehend what has been sent will depend upon the speed with which the S-meter reacts to changes in signal level (which on my HT, wasn't terribly quickly). But, for those of us who send and receive code at modest speeds—say, 1 or 2 words per minute—mechanical sending and receiving limitations shouldn't pose a problem.[4]

***Attempt #2 -- Using an Intelligent Receiver***

The bit I got out of Don's discussion of heterodynes and beat frequency oscillators is that the receiver detects signal on a particular frequency and "knows" to generate a 700 Hz tone. Can I come up with a receiver that "knows" to make a sound when it detects a signal on the frequency it is monitoring? I have a perfectly good code practice oscillator that "knows" how to make a sound when it gets a voltage from a connected key. Can I attach the CPO to something that will generate a voltage when is detects a signal?

In casting about the Internet for ideas, I came across a "photoresistor". This little fellow (Figure 1) is normally a high-resistance device. When illuminated with sufficient light, on the other hand, a photoresistor becomes a low-resistance device. I might be able to replace the Morse code key in my CPO with a photoresistor and then "key" the CPO with light.

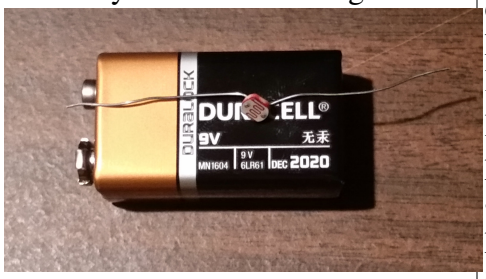



*Figure 1: A photoresistor sitting on a 9V battery. Note that--this month--the battery is not one that expired eighteen years ago.*

Depending upon your source and the number you buy, GL5528 photoresistors cost between a nickel and a dollar. At that price, I can afford an experiment.

Figure 2 shows my indiscriminate Terahertz receiver. It is last month's code practice oscillator, except that I've replaced the key connection with a GL5528 photoresistor. You can see it at the top left of the breadboard. I bent it over to accept light coming from the left.

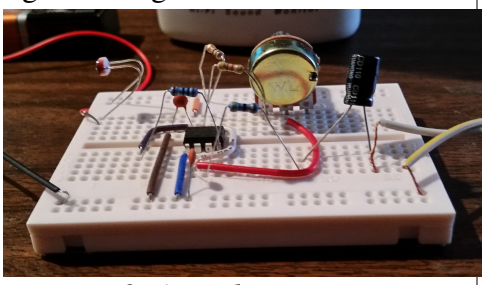


*Figure 2: An indiscriminate THz receiver*

Ambient room lighting did not close the circuit. Good.

An LED flashlight right next to the photoresistor generates a CPO tone. Good.

Pulling the flashlight a few feet away from the photoresistor ... does not generate a tone. Hmm. I either need a bigger light or a more coherent light source--that is, a highly directional transmitter. A laser pointer, perhaps?

I aimed a red laser pointer at the photoresistor from across the room and, when properly aimed, completed the circuit and heard the squawk of the 555-based code practice oscillator. This is going to work!

The problem is that my target photoresistor is pretty small and a hand-held laser pointer is tough to aim, especially when pushing the

***see THE AMATEUR on page 13***

[3] Someone more adventurous--and more confident of his soldering skills--than I might open up his HT to wire a different kind of switch—say, a Morse code key—to replace the PTT switch. It may be, however, that the internal circuitry of the HT was not built to anticipate rapid PTT keying either. If I try this someday, it will be with an expendable HT.

[4] It occurs to me that visual PTT code transmission on HTs is a bit like Newtonian physics. At my speed, both PTT keying and Newtonian physics work just fine. As one accelerates--whether that is measured in miles per hour or words per minute—both Newtonian physics and PTT keying break down.

***from THE AMATEUR on page 12***

on-off button to send my Morse code.

Figure 3 shows my solution: a 635 nm CW transmitter. Alligator clips connect the laser pointer to my key (off to the left), the key to a 3.3V power source and from the 3.3V power source back to the other terminal of the laser pointer. I applied masking tape liberally to insulate the alligator clips and to depress the button on the laser pointer. Then I taped the whole thing to a base so that I could keep it aimed at the photoresistor.

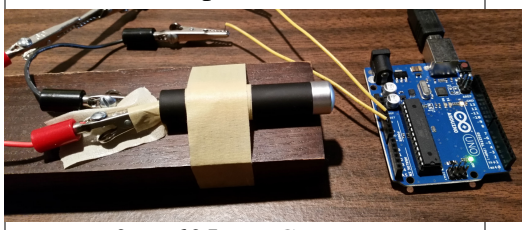


*Figure 3: a 635 nm CW transmitter*

Incidentally, the blue thing in the picture is an Arduino microcontroller board which, when connected to USB power, generates 3.3V for the laser pointer.

The only trick to the assembly is making appropriate connections with 3.3V and ground. Fortunately, you can't hurt anything. I know that because after carefully calculating which alligator clips to connect to which Arduino pins to duplicate the current flow from the laser pointer's original AA batteries ... I promptly connected them backwards. Nothing exploded. I reversed the connection and everything worked fine.

The way I see it, 473.3 THz (plus or minus) fits in the "all above 300 GHz" band, making this an amateur frequency. The ARRL backs me up, noting--in its report of "10 GHz and Up" contest results--that various hams completed QSOs at lightwave frequencies, albeit over somewhat longer distances than I.

I declare the project to be a success!

***ODDS AND ENDS - Morse Code***

Have you seen the computer software tools for learning Morse code? They're pretty impressive.

I've downloaded "Just Learn Morse Code". I've set it to form characters at 20 WPM and to send characters at 5 WPM. I start with a small computer-selected character set and add letters as I get comfortable. That might be the "Koch" method, or the "Farnsworth" method, or both, or something else.

I am getting used to the sound of characters at 20 WPM, but only have to think and translate at 5 WPM. A small character set means that I have fewer things to remember and have a gratifyingly high success rate early on. Every—well, *almost* every—morning I do a five-minute practice session, typing the characters as I hear them. If I do well, I add a character the next day. If I do not do well, I repeat the session with the same set of characters, either immediately or (more typically) the next day.

There may be a reason the software picks what new letter I am to learn each day, but I cannot discern a pattern.

The plan, once I get the whole character set learned, is to keep character formation at 20 WPM, but to reduce the spacing between characters from 5 to 6 to 7 to … 20 WPM.

This may not the best way for me--or anyone--to learn code. I figure, however, that doing SOMETHING improves my code faster than searching around and trying different techniques to identify what is going to work best. It is undoubtedly true that the journey of a thousand miles begins with the first step, but it seems to me that the guy who actually takes that first step is likely to get there ahead of the guy who puts off the first step until he determines whether some other shoes might be better than the ones he is wearing.

Incidentally, I told **Jamie Charlton ADØAB**, what I was doing and learned that "no one" sends punctuation and that, therefore, my time working on periods and commas was not well spent. Dashes and question marks, on the other hand, were useful. I found that "Just Learn" had a way to turn individual bits of punctuation on and off. For now, I've turned off punctuation and will focus on letters and numbers.

At the first January club meeting, after the club officers collected ideas for club programs for 2016, **Ted Knapp, NØTEK,** told me that liked someone's suggestion about a CW class at club meetings. He observed that the advantage of a class was the accountability. If you signed up, you had to show up. Of course, the other way to ensure accountability is a public commitment to learn. I made my commitment in the January issue of the FEEDBACK. **Herb Fiddick, NZØF**, however, was less bold. He told me not to tell anyone that his wife gave him a Morse code key for Christmas. I assured him that no one would HEAR anything from me.

***-- FEEDBACK --***